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10/534,075	02/17/2006	Stuart Leon Soled	P2002J113	2781

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EXAMINER	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/534,075	SOLED ET AL.	
	Examiner	Art Unit	
	Taylor Victor Oh	1625	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 May 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-38* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-38* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *06 May 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

<u>The Status of Claims:</u>

Claims 1-38 are pending.

Claims 1-38 are rejected.

DETAILED ACTION

Priority

1. It is noted that this application is a 371 of PCT/EP03/12885(11/18/2003), which has a foreign priority document, United Kingdom 0227086.6(11/20/2002).

Drawings

2. The drawing filed on 5/06/05 is accepted by the examiner.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-34 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for using MCM-41/Ru, Ru-TEA, Ni/ Al_2O_3, nickel, palladium, platinum, rhodium, cobalt, ruthenium, their combinations thereof as the catalyst, does not reasonably provide enablement for using any catalysts generally.

The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to include all kinds of metal catalysts unrelated to the claimed invention commensurate in scope with these claims.

Furthermore, the instant specification fails to provide information that would allow the skilled artisan to practice the instant invention without **undue experimentation.** Attention is directed to *In re Wands*, 8 USPQ2d 1400 (CAFC 1988) at 1404 where the court set forth the eight factors to consider when assessing if a disclosure would have required undue experimentation, citing *Ex Parte Forman*, 230 USPQ 546 (BdApls 1986) at 547 the court recited eight factors:

1) the quantity of experimentation necessary,
2) the amount of direction or guidance provided,
3) the presence or absence of working examples,
4) the nature of the invention,
5) the state of the prior art,
6) the relative skill of those in the art,
7) the predictability of the art, and
8) the breath of the claims.

The Nature of the Invention

The nature of the invention in claim 1 is described below:

1. (original): A process for hydrogenating an organic compound, which process comprises bringing the organic compound into contact, under hydrogenation conditions, with a source of hydrogen in the presence of a catalyst comprising one or more catalytically active metal sites located on a catalyst support and recovering the hydrogenation products, wherein at least one of the catalytically active metal sites has been obtained via the partial decomposition on the support of a complex of the metal and a nitrogen-containing organic compound selected from (i) amino acids and (ii) compounds containing both an amino group and an alcohol group, partial decomposition having been carried out such that new vibration bands appear in the infra red spectrum of the complex at between 2100-2200 cm^{-1}.

The State of the Prior Art

The states of the prior art are described as followed:

[005] In U.S. Pat. No. 5,286,898 and U.S. Pat. No. 5,319,129, dimethylterephthalate is hydrogenated at $\geq 140°$ C and a pressure of from 50 to 170 bar over supported Pd catalysts, which are treated with Ni, Pt and/or Ru to give the corresponding dimethylhexahydroterephthalate. The supports used are alumina of crystalline phase alpha or theta or delta or gamma or beta or mixtures thereof.

[006] In EP-A-0 005 737, aromatic carboxylic esters are hydrogenated at from 70 to 250° C and from 30 to 200 bar over supported Ni, Ru, Rh and/or Pd catalysts to give the corresponding cycloaliphatic carboxylic esters. The support used is an aluminium oxide of which at least 20% has been converted into lithium-aluminium spinel.

[007] U.S. Pat. No. 3,027,398 describes the hydrogenation of dimethylterephthalate over supported Ru catalysts at from 110 to 140° C and from 35 to 105 bar. The Ru is deposited on charcoal or kieselguhr.

[008] EP-A 0 603 825 relates to a process for the preparation of 1,4-cycylohexanedicarboxylic acid by hydrogenating terephthalic acid by using a supported palladium catalyst, wherein as support alumina, silica or active charcoal is used.

[009] U.S. Pat. No. 3,334,149 describes a multistage process for the hydrogenation of dialkylterephthalate using a Pd catalyst followed by use of a copper chromite catalyst.

[010] U.S. Pat. No. 5,936,126 describes a process for the hydrogenation of an aromatic compound. The catalyst used contains ruthenium as active metal alone or optionally with one or more other Group IB, VIIB or VIIIB metals on a macroporous support. The macroporous support exhibits an average pore diameter of at least 50 nm and a BET surface area of not more than about 30 m^2/g.

[011] U.S. Pat. No. 6,248,924 describes a process for reacting organic compounds. The catalyst used contains ruthenium as active metal alone or optionally with one or more other Group IB, VIIB or VIIIB metals on a support. The support may be a material having macropores (50 to 10000 nm pore diameter) and mesopores (2 to 50 nm pore diameter). In the support 10 –50% of the pores are macropores and 50 to 90% of the pores are mesopores. Alumina of surface area (BET) 238 m^2/g is specifically exemplified.

As the prior art have been discussed in the above, there is no conclusive data that all kinds of catalysts would be required to produce the final desired product except some metal hydrogenation catalyst, nickel, palladium, platinum, rhodium, ruthenium, cobalt, and etc.

The predictability or lack thereof in the art

In the instant case, the instant claimed invention is highly unpredictable since one skilled in the art would recognize that not every catalyst would work on the claimed process in the same way as do those metal catalysts such as MCM-41/Ru, Ru-TEA, Ni/ Al_2O_3, nickel, palladium, platinum, rhodium, cobalt, ruthenium, their combinations thereof disclosed in the specification. Furthermore, the specification of the claimed invention does support the very idea of the unpredictable aspect of the catalysts by disclosing those specific and workable metal catalysts (see page 35) for the metal hydrogenation catalyst in the above, not that all kinds of the metal catalyst known in the art will work.

Moreover, chemical reactions are well-known to be unpredictable, *In re Marzocchi*, 169 USPQ 367, *In re Fisher*, 166 USPQ 18. Additionally, catalytic processes, such as are present here, are inherently unpredictable. The U.S. District Court District of Connecticut held in MOBIL *OIL CORPORATION v. W.R. GRACE & COMPANY*, 180 USPQ 418 that "there is an inherent mystery surrounding the unpredictability of the performance of catalysts; a mystery which is generally recognized

and acknowledged by chemists in the cracking art. This is one more reason why the presumption of patent validity "should not be disregarded especially in a case of this sort where the intricate questions of [bio]chemistry involved are peculiarly within the particular competence of the experts of the Patent Office." *Merck & Co. v. Olin Mathieson Chemical Corp.*, 253 F.2d 156, 164, 116 USPQ 484, 490 (4th Cir. 1958)". "The catalytic action can not be forecast by its chemical composition, for such action is not understood and is not known except by actual test, *Corona Cord Tire Co. v. Dovan Chemical Corp.*, 276 U.S. 358, 368-369 (1928). Also see, *Application of Grant*, 304 F.2d 676, 679, 134 USPQ 248, 250-251 (CCPA 1962); *Rich Products Corp. v. Mitchell Foods, Inc.*, 357 F.2d 176, 181, 148 USPQ 522, 525-526 (2d Cir. 1966), cert. denied 385 U.S. 821, 151 USPQ 757 (1966); *Ling-Temco-Vought, Inc. v. Kollsman Instrument Corp.*, 372 F.2d 263, 268, 152 USPQ 446, 450-451 (2d Cir. 1967); *Georgia-Pacific Corp. v. United States Plywood Corp.*, 258 F.2d 124, 132-133, 118 USPQ 122, 128-129."

Therefore, from the above, it is clear that the use of every generic " a catalyst" will not form the desired claimed product in a good yield.

The amount of direction or guidance present

The direction present in the instant specification is that not any catalyst can be led to the formation of the desired product. According to the specification, it is silent as to how any catalyst can be led to the formation of the desired product and fails to provide guidance as to whether any acidic catalyst is sufficient enough to allow to form

the desired product in sufficient quantities; the specification fails to provide a correlation between the claimed process of the invention and the functional language of any catalyst.

The presence or absence of working examples

In the instant case, the claim encompasses all the various catalysts. Applicants' specification provide some particular exemplified catalysts such as MCM-41/Ru, Ru-TEA, Ni/ Al_2O_3, as shown in the examples for producing the desired compound in the specification.

However, this can not be the representatives for all the metal catalysts which would work for the claimed process. Thus, the specification fails to provide enough working examples as to how other types of metal catalysts can be resulted in the claimed products, i.e. again, there is no correlation between the functional language of any metal catalyst and the desired final product.

The breadth of the claims

The breadth of the claims is that any metal catalyst would work on the claimed process in the same way as those disclosed catalyst in the specification without considering the affect or impact of the different types of metal catalysts on the reactants.

The quantity of experimentation needed

The quantity of experimentation needed is large. One of skill in the art would need to determine which one of the metal catalysts would be capable of forming the desired product and would furthermore then have to determine which one of the metal

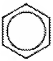
catalysts would not be resulted in the claimed desired compounds in a sufficient quantity.

The level of the skill in the art

Even though the level of skill in the art of hydrogenation process is high, the skilled artisan employing this process would be a BS Chemist working in a laboratory facility. He would know how to use the taught metal catalyst, but not how to select other catalyst without trial and error.

Therefore, in view of the Wands factors and In re Fisher (CCPA 1970) discussed above, to practice the claimed invention herein, a person of skill in the art would have to engage in undue experimentation to test which metal catalyst can be employed to produce the desired claimed compound encompassed in the instant claims, with no assurance of success.

Claim 1-3,6-38 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for using the compound having following organic groups such as

$C{=}C$, $C{\equiv}C$,  , $C{=}N$, $C{\equiv}N$, $C{=}O$, $C{=}S$,

$—NO_2$

as the organic compound, does not reasonably provide enablement for any organic compounds generally. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to include all kinds of organic compounds unrelated to the claimed invention commensurate in scope with these claims.

Furthermore, the specification has not described how all kinds of organic compounds in contact with a source of hydrogen in the presence of a catalyst will form naturally the hydrogenation products by the hydrogenation process under unspecified reaction parameters ,such as any pressure and any temperature. This description is essential to the claimed invention because it allows to distinguish identifying characteristics sufficient to show that the applicant was in possession of the claimed invention, and the claim ,as a whole, may not be adequately described where the invention is described solely in terms of a process of its making coupled with its reaction conditions, i.e. temperature and pressure suitable for all kinds of the alkynes, alkenes, nitriles, and/or ketones. As a matter of fact, the specification describes that the nature of the organic compound has to be considered in view of the reaction temperature ranges (50 to 250 ^{0} C) and pressure ranges (10 to 300 bar) ; for example, the B.P. of acetonitrile is 81 ^{0} C, whereas that of 1,4-dicyanobutane is 295^{0} C at 1 atm as shown in the Experimental Organic Chemistry Textbook (see page 658, table 28.16, 1980).

Furthermore, the same Experimental Organic Chemistry Textbook, Tables 28.16 and 28.17 have shown that acetonitrile, propionitrile, 1,4-dicyanobutane are in

liquid form ,whereas 4-methylbenzyl cyanide, cinnamonitrile, 1,2-dicyanobenzene are in a solid form. Therefore, it is important to specify the reaction temperature and pressures in order to successfully carry out the reaction process with given starting materials.

Therefore, the specification has failed to describe the subject matter in the claims as to the relationship between all kinds of organic starting materials and the final product during the processing steps of making the desired product.

The specification falls short because data essential for how all kinds of organic starting materials would be led to forming the final desired hydrogenation products by the hydrogenation process.

Furthermore, the instant specification fails to provide information that would allow the skilled artisan to practice the instant invention without **undue experimentation.** Attention is directed to *In re Wands*, 8 USPQ2d 1400 (CAFC 1988) at 1404 where the court set forth the eight factors to consider when assessing if a disclosure would have required undue experimentation, citing *Ex Parte Forman*, 230 USPQ 546 (BdApls 1986) at 547 the court recited eight factors:

1) the quantity of experimentation necessary,

2) the amount of direction or guidance provided,

3) the presence or absence of working examples,

4) the nature of the invention,

5) the state of the prior art,

6) the relative skill of those in the art,

7) the predictability of the art, and

8) the breath of the claims.

The Nature of the Invention

The nature of the invention in claim 1 is described below:

1. (original): A process for hydrogenating an organic compound, which process comprises bringing the organic compound into contact, under hydrogenation conditions, with a source of hydrogen in the presence of a catalyst comprising one or more catalytically active metal sites located on a catalyst support and recovering the hydrogenation products, wherein at least one of the catalytically active metal sites has been obtained via the partial decomposition on the support of a complex of the metal and a nitrogen-containing organic compound selected from (i) amino acids and (ii) compounds containing both an amino group and an alcohol group, partial decomposition having been carried out such that new vibration bands appear in the infra red spectrum of the complex at between 2100-2200 cm^{-1}.

The State of the Prior Art

The states of the prior art are described as followed:

[005] In U.S. Pat. No. 5,286,898 and U.S. Pat. No. 5,319,129, dimethylterephthalate is hydrogenated at ≧140° C and a pressure of from 50 to 170 bar over supported Pd catalysts, which are treated with Ni, Pt and/or Ru to give the corresponding dimethylhexahydroterephthalate. The supports used are alumina of crystalline phase alpha or theta or delta or gamma or beta or mixtures thereof.

[006] In EP-A-0 005 737, aromatic carboxylic esters are hydrogenated at from 70 to 250° C and from 30 to 200 bar over supported Ni, Ru, Rh and/or Pd catalysts to give the corresponding cycloaliphatic carboxylic esters. The support used is an aluminium oxide of which at least 20% has been converted into lithium-aluminium spinel.

[007] U.S. Pat. No. 3,027,398 describes the hydrogenation of dimethylterephthalate over supported Ru catalysts at from 110 to 140° C and from 35 to 105 bar. The Ru is deposited on charcoal or kieselguhr.

[008] EP-A 0 603 825 relates to a process for the preparation of 1,4-cycylohexanedicarboxylic acid by hydrogenating terephthalic acid by using a supported palladium catalyst, wherein as support alumina, silica or active charcoal is used.

[009] U.S. Pat. No. 3,334,149 describes a multistage process for the hydrogenation of dialkylterephthalate using a Pd catalyst followed by use of a copper chromite catalyst.

[010] U.S. Pat. No. 5,936,126 describes a process for the hydrogenation of an aromatic compound. The catalyst used contains ruthenium as active metal alone or optionally with one or more other Group IB, VIIB or VIIIB metals on a macroporous support. The macroporous support exhibits an average pore diameter of at least 50 nm and a BET surface area of not more than about 30 m^2/g.

[011] U.S. Pat. No. 6,248,924 describes a process for reacting organic compounds. The catalyst used contains ruthenium as active metal alone or optionally with one or more other Group IB, VIIB or VIIIB metals on a support. The support may be a material having macropores (50 to 10000 nm pore diameter) and mesopores (2 to 50 nm pore diameter). In the support 10 --50% of the pores are macropores and 50 to 90% of the pores are mesopores. Alumina of surface area (BET) 238 m^2/g is specifically exemplified.

As the prior art have been discussed in the above, there is no conclusive data that all kinds of starting organic materials would produce the final hydrogenation products except some aromatic compounds such as terephthalic acid, dialkyl terephthalate.

The predictability or lack thereof in the art

In the instant case, the instant claimed invention is highly unpredictable since one skilled in the art would recognize that not every any organic starting material would produce the desired hydrogenated products. This is because hydrogenation process

needs three components, the unsaturated substrate, hydrogen or hydrogen source, and the specific catalyst; the success of carrying out the reaction depends on the good selection of the substrate and of the specific catalyst with a high activity in combination with adjusting suitable temperatures and pressures.

Furthermore, the specification of the claimed invention does support the very idea of the unpredictable aspect of the organic starting materials by disclosing those specific and workable starting compounds (see pages 19-24) for the process; it does not support all kinds of organic starting materials known in the art.

Moreover, chemical reactions are well-known to be unpredictable, *In re Marzocchi*, 169 USPQ 367, *In re Fisher*, 166 USPQ 18. From the above, it is clear that the use of every generic "an organic compound" will not form the desired claimed product in a good yield.

Therefore, in view of the Wands factors and In re Fisher (CCPA 1970) discussed above, to practice the claimed invention herein, a person of skill in the art would have to engage in undue experimentation to test which acidic catalyst can be employed to produce the desired claimed compound encompassed in the instant claims, with no assurance of success.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-38 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claims 1-4, 10-11,16-17, the terms " derivative", "comprise(s) ", "containing" are recited. Each of these is vague and indefinite because the specification does not elaborate what is meant by the term " derivatives"; and the terms of "comprise(s) " and "containing" would mean that there are some additional components besides the only compounds; the skilled artisan in the art is unable to figure out what else are present in the compounds.

Therefore, an appropriate correction is required.

In claim 21, the term" TGA " is recited. This is vague and indefinite because the term" TGA " can have any other meaning than what it has been intended; the examiner recommends it to be specified in the claim. Therefore, an appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brunner et al (US 6,284,917) in view of Sugier et al (US 3,761,428) and Scott (US 2,889,287).

Brunner et al discloses the method of hydrogenating benzene polycarboxylic acids or derivatives by using the catalyst containing amine complexes of the metal salts of transition group I, VII or VIII of the periodic table to a suitable support in the followings.

A process for hydrogenating a benzenepolycarboxylic acid or a derivative thereof or a mixture of two or more thereof by bringing the benzenepolycarboxylic acid or the derivative thereof or the mixture of two or more thereof into contact with a hydrogen-containing gas is carried out in the presence of a catalyst which comprises as active metal at least one metal of transition group VIII of the Periodic Table alone or together with at least one metal of transition group I or VII of the periodic table applied to a support which contains macropores with the proviso that if dimethyl terephthalate is hydrogenated, the hydrogenation using a catalyst which comprises as active metal ruthenium either alone or together with at least one metal of transition group I, VII or VIII of the Periodic Table applied to a support, where the support has a mean pore diameter of at least 50 nm and a BET surface area of at most 30 m^2/g and the amount of the active metal is from 0.01 to 30% by weight, based on the total weight of the catalyst, and the ratio of the surface areas of the active metal and the catalyst support is less than 0.05, and/or

a catalyst which comprises as active metal ruthenium either alone or together with at least one metal of transition group I, VII or VIII of the Periodic Table in an amount of from 0.01 to 30% by weight, based on the total weight of the catalyst, applied to a support, where from 10 to 50% of the pore volume of the support is formed by macropores having a pore diameter in the range from 50 nm to 10,000 nm and from 50 to 90% of the pore volume of the support is formed by mesopores having a pore diameter in the range from 2 to 50 nm, where the sum of the pore volumes adds up to 100%, is excluded, and novel hydrogenation products, obtainable by hydrogenating benzenepolycarboxylic acid (derivatives) as well as their use as plasticizers in plastics.

(see abstract page)

In the process of the present invention, the hydrogenation is generally carried out at from about 50 to 250° C., preferably from about 70 to 220° C. The pressures used here are generally above 10 bar, preferably from about 20 to about 300 bar.

(see col. 7 ,lines 55-62)

The catalysts 1 used according to the present invention can be produced industrially by applying at least one metal of transition group VIII of the Periodic Table and, if desired, at least one metal of transition group I or VII of the Periodic Table to a suitable support.

The metal(s) can be applied by steeping the support in aqueous metal salt solutions such as aqueous ruthenium salt solutions, by spraying appropriate metal salt solutions onto the support or by other suitable methods. Suitable metal salts of transition group I, VII or VIII of the Periodic Table are the nitrates, nitrosyl nitrates, halides, carbonates, carboxylates, acetylacetonates, chloro complexes, nitrito complexes or ammine complexes of the corresponding metals, with preference being given to the nitrates and nitrosyl nitrates.

In the case of metals which have not only a metal of transition group VIII of the Periodic Table but also further metals applied as active metals to the support, the metal salts or metal salt solutions can be applied simultaneously or in succession.

The supports which have been coated or impregnated with the metal salt solution are subsequently dried, preferably at

(see col. 3 ,lines 45-67)

from 100 to 150° C., and, if desired, calcined at from 200 to 600° C., preferably from 350 to 450° C. In the case of separate impregnation, the catalyst is dried and, if desired, calcined as described above after each impregnation step. The order in which the support is impregnated with the active components is immaterial.

(see col. 4 ,lines 1-6).

However, the instant invention differs from the prior art in that the catalyst containing hydroxyalkylamines and amino acids are unspecified.

Sugier et al teaches the hydrogenation catalyst containing platinum and iridium along with impregnation solution containing amino alcohols:

Typical amino-alcohols are ethanolamine, propanolamines, butanolamines, diethanolamine, 2,2-diamino-1,3-propanediol, 2,2,3-triamino-1-propanol or triethanolamine. Ethanolamine is the preferred amino-alcohol.

It has been found that the quality and the homogeneity of this impregnation may be substantially improved by using, as impregnation solution, an aqueous solution of platinum and iridium compounds containing an amino-alcohol having, for example 1 to 6 OH groups and 1 to 6 amine groups and preferably 2 to 20 carbon atoms per molecule, the pH of the solution being at most 4 and preferably at least 1, or better, 1.5, equivalent to pH ranges of 1–4 and 1.5–4, respectively.

Furthermore, Scott discloses the preparation of the catalyst composition useful for hydrogenation (see col. 13 ,lines 1-6).

It is another object of the invention to provide a method whereby a porous carrier or support can be impregnated with two or more catalytically active metals simultaneously in cases where simultaneous impregnation has not been possible in the past because of the inability to retain the different metals or metal compounds in the same solvent without the formation of a precipitate. A further object is to introduce said different metals simultaneously in such form as to achieve greatly improved activity compared to that possible via conventional preparations.

The foregoing objects are attained pursuant to the invention by wetting a catalyst support with a dispersion of a metal chelate, comprising an amino acid as the chelating agent, in a liquid carrier and heating the wetted support to evaporate the liquid carrier and to decompose the amino acid.

It has now been found that catalysts having substantially enhanced activity may be produced if the catalytically active metal is converted to a metal chelate compound using an organic amino acid as the chelating agent and the catalyst support is impregnated with the chelate compound. In such a metal chelate, the amino acid by means of two or more valences, principal or residual, or both, attaches itself to the metallic ion to form a heterocyclic ring. Since both the amino and carboxyl groups are highly active chelate donor groups, the amino acid chelates are among the most stable chelates known. The rings formed are particularly stable when the number of constituent atoms is in the range from 5 to 8; hence, alpha-, beta-, gamma- and delta-amino acids are preferred for use in this invention.

The metal-amino acid chelate compounds employed pursuant to the invention can be advantageously formed using amino acids of relatively low molecular weights, the chelates of which are soluble in water or other solvents. Amino acid chelates and chelate salts which are water-soluble are especially preferred, since the water solvent need not be collected as the impregnated support is dried. Also, clustering of chelated molecules is minimized when the chelate compound can exist in the form of ions in an aqueous solution. Metal-amino acid chelates

(see col. 2 ,lines 26-67)

soluble in the desired extent in water or polar organic solvents are best prepared if the amino acid contains no more than 20 carbon atoms, and representative amino acids coming within this preferred category are ethylenediamine tetraacetic acid (EDTA), N-2-hydroxyethyl ethylenediamine triacetic acid (EDTA—OH), aspartic acid, glutamic acid, tryptophan, valine, phenylalanine, alpha-alanine, beta-alanine and asparagine. A still more preferred class of compounds for use in the present invention is made up of polycarboxylic amino acids such as EDTA, EDTA—OH, glutamic acid and aspartic acid.

(see col. 3 ,lines 1-11).

Those metals of groups II to VIII, inclusive, of the periodic table which are capable of chelation, or which can form salts of chelates as later disclosed, can be efficiently dispersed on a catalyst support pursuant to the invention. The process is especially valuable in preparing supported catalysts containing metals of groups VI and VIII, not only because of enhanced catalytic activity, but because smaller amounts of these rather expensive materials can be so advantageously disposed on the carrier that a catalytic effect equal to that of conventionally prepared catalysts having much higher contents of active catalytic material is obtained. Particularly good results have been obtained with chelates of the metals platinum, nickel, cobalt, molybdenum and chromium, either alone, or in the form of chelate salts wherein two of such metals are present, e.g., molybdenum and cobalt, cobalt and chromium, zinc and chromium, or nickel and chromium.

The metal-amino acid chelates are stable and the vapor pressure of the chelated amino acid is low; as a result, the metal chelate compound remains intact during the drying of the impregnated support. Since the catalyst produced by the method of this invention shows no formation of crystals or crystallites of the catalytically active metal material, it is believed that the metal atoms, sterically shrouded by the atoms of the chelating agent, have little or no tendency to migrate and form crystals during the drying of the solvent from the impregnated support. The resultant enhanced activity of the catalyst may then be explained by a decrease in, or absence of, exposed areas of the support as a result of suppressing the migration of the catalytically active atoms during drying.

In the preparation of the catalysts of the invention, a dispersion of the metal-chelate compound in a suitable solvent (the term dispersion as employed herein also including those systems wherein the chelate is present in solution) is generally contacted with a previously dried support. However, it may also be contacted with a wet or freshly precipitated carrier gel to accomplish the desired impregnation. After impregnation, the carrier or support is dried to remove the solvent. The metal-chelate compound remains intact during the drying and is thereafter decomposed to the metal or metal oxide by calcining. The oxide may be converted to different catalytically active metal compounds, if desired, by conventional chemical treatment, such as to the reduced metals, the sulfides, the halides, etc. The metal-chelate which is deposited on the dried support can also be converted

(see col. 3 ,lines 25-75).

Brunner et al expressly discloses the method of hydrogenating benzene polycarboxylic acids or derivatives by using the catalyst containing amine complexes of the metal salts of transition group I, VII or VIII of the periodic table to a suitable support. Similarly, Sugier et al teaches the hydrogenation catalyst containing platinum and iridium along with impregnation solution containing amino alcohols; Moreover, Scott discloses the preparation of the catalyst composition containing the amino acid complexes of metal salts of transition group II to VIII of the periodic table to a suitable support useful for hydrogenation (see col. 13 ,lines 1-6).

All three prior art processes are commonly involved in applying their catalyst compositions to hydrogenation process. Sugier et al has demonstrated that the quality and the homogeneity of the catalyst composition can substantially be improved by the impregnation solution containing platinum and iridium compounds having the aminoalcohols; in addition, Scott advocates that the activity of the catalyst can be greatly improved when the catalytically active is converted to the metal chelate compound using the organic amino acid with which the catalyst support is impregnated.

Therefore, it would have been obvious to the skilled artisan in the art to be motivated to incorporate the teachings of Sugier's et al impregnation solution containing the aminoalcohols in combination with Scott's metal amino acid chelates into the Brunner et al process in order to enhance the activity of the catalyst composition for the process of hydrogenation. This s because the skilled artisan in the art would expect such a combination to be feasible and successful as guidance shown in the prior art.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Taylor Victor Oh whose telephone number is 571-272-0689. The examiner can normally be reached on 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Janet Andres can be reached on 571-272-0867. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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